

THE BIOLOGY OF *RHINONCUS AUSTRALIS* OKE (COLEOPTERA: CURCULIONIDAE), A WEEVIL ATTACKING THE WEED *EMEX AUSTRALIS* STEINHEIL IN EASTERN AUSTRALIA

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Abstract

The introduced weed *Emex australis* is attacked by the native weevil *Rhinoncus australis*. Adult *R. australis* fed on all plant parts except roots, mature fruits and male flowers. Most eggs (83%) were deposited in pits in stems, petioles and developing fruit. The larvae tunnelled actively in stems, petioles and the pericarp of young fruit. Pupation occurred in chambers inside stems.

Adult males lived as many as 245 days, females 191 days, and as many as 579 eggs were laid. The average time between generations, i.e. the time from emergence of one adult to the emergence of its progeny is 45 days (range 38-53).

Under insectary conditions *R. australis* retarded growth and seed production of *E. australis*. Field populations of *R. australis* increased in spring and early summer but were never large enough to affect growth or seed production of the weed.

Introduction

The weevil, *Rhinoncus australis* Oke, 1931, is a native of Australia. We have observed it feeding on four species of Polygonaceae including the weed *Emex australis* Steinheil at Two Wells and Port Pirie, South Australia; Ootha (near Parkes), New South Wales; Ma Ma Creek and Queensland Agricultural College (near Gatton), Queensland; *E. spinosa* Campdera at Merbein, Victoria; *Rumex brownii* Campdera and *R. crispus* L. at Brisbane, Queensland. It has also been collected from *Polygonum persicaria* L. in New Zealand (E. C. Zimmerman, pers. comm., 1978).

Our interest in this insect developed during 1974 and 1975 during field evaluation of the weevil *Perapion antiquum* (Gyllenhal) which had been introduced for biological control of *E. australis* (Harley and Kassulke, 1975; Julien and Harley, 1978). Of organisms found attacking *E. australis*, the only one causing consistent damage and having a mode of attack similar to that of *P. antiquum* was *R. australis*.

Methods and materials

An insectary colony of *R. australis* was established using adults collected from Ma Ma Creek, Queensland, in December 1976, and *E. australis* as the food plant. Progeny of this colony were used in these studies.

Mature adults were confined on *E. australis* plants for 24 hours and then removed. Plants were held in the insectary and at intervals were sampled to determine larval and pupal development rates and to obtain immature stages for measurement. Newly emerged adults were placed on *E. australis* for observations of feeding, copulation and oviposition. The insectary temperature was $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

Pupae were removed from the *E. australis* stems and placed on moist filter paper. After emergence the adults were sexed and pairs were then separated and held on *E. australis*. Oviposition was monitored and the number of eggs and their location on the plant recorded. The longevity of unfed adults and adults allowed to feed on *E. australis* for 8 days and then starved was also recorded. These observations were carried out under laboratory conditions where the daily temperature was $25^{\circ} \pm 5^{\circ}\text{C}$.

Field observations were made at Two Wells, South Australia and Ma Ma Creek, Queensland, between 1975 and 1977.

Biology

Adults. Adults of *R. australis* (Fig. 1) are ca 2.5 mm long and vary in colour from tan to dark brown or charcoal. Areas of whitish body setae give a mottled appearance. Many specimens have a small patch of white scales on the anterior section of the adjoining edges of the elytra. Newly developed adults are cream to beige but darken and harden during the first 24 hours. Emergence occurs through holes, 1.5 - 2.5 mm diameter, cut in the stem wall of *E. australis* generally near the base of stems. *R. australis* is a jumping weevil and has not been observed flying.

In adult females, the posterior edge of ventrite 5 is straight whereas the posterior edge in the male is shallowly "V"-shaped (Figs 2, 3). There is an emargination in the male pygidium on the mid-line and adjacent to the 5th ventrite (Fig. 3). Ventrite 1 is slightly concave along the mid-line in the male and flat or slightly convex in the female.

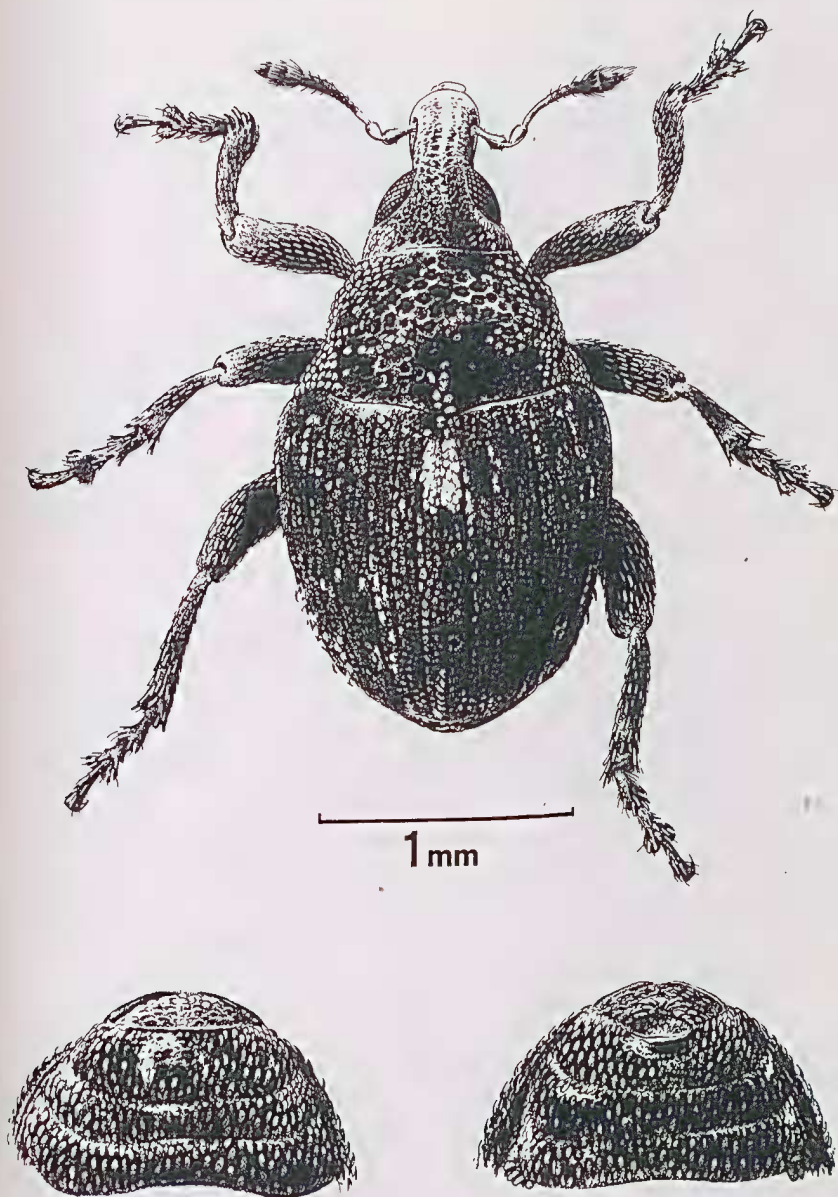
Feeding commenced within several hours of emergence and was observed on all plant parts except roots, mature fruit and male flower clusters. Irregularly-shaped feeding holes up to 2 mm diameter were made in the lamina. Feeding pits made on other plant parts were up to 2 mm long and 1 mm wide and caused damage to epidermal and vascular tissue.

Adults lived for a considerable time, four out of eight males and four out of eight females lived for more than 100 days. Males lived as long as 245 days and females as long as 191 days. Unfed adults had all died within 23 days while adults fed for eight days and then starved, had all died within 49 days.

Oviposition. The mean pre-mating period was 2.5 days (range 2-3) and pre-oviposition period 6 days (range 4-8). Repeated copulation occurred frequently throughout the duration of the ovipositional period.

Thirty-eight percent of eggs laid were found on stems of the host, 26% on petioles, and 20% on the soft pericarp of developing fruit; of the remainder, 7% were found on laminae, 5% on midribs, and 4% on female flowers. Eggs were deposited singly in small pits, sometimes with part of the egg protruding above the epidermal layer and often the egg and pit were covered with a black excretion.

In the laboratory an average of 3.6 eggs (range 1.8 - 5.9) was laid per day. Oviposition continued for up to 146 days with four out of eight individuals



Figs 1-3. *Rhinoncus australis* Oke: (1) adult; (2, 3) abdomen, ventral view, showing 3rd, 4th and 5th ventrites and pygidium, (2) ♀, (3) ♂.

having an oviposition period longer than 100 days. As many as 579 eggs were laid by one female and four out of eight females produced more than 290 eggs each.

Eggs. Eggs were oval in shape, 0.58 x 0.40 mm, and finely reticulated. They were cream coloured following deposition and darkened during the first 24 hours. Eggs hatched after 4 days (range 2-7) (Table 1).

TABLE 1
Duration of developmental stages of *Rhinoncus australis*

Stage	Duration (days)	
	mean	range
Pre-oviposition period	6	4 - 8
Incubation	4	2 - 7
Larva	30	27 - 32
Pupa	5	5 - 6
Time between generations	45	38 - 53
Oviposition to emergence of adult	39	34 - 45

Larvae. Completion of larval development took an average of 30 days (range 27-32) (Table 1). There were three larval instars, distinguished by head capsule width measurements. The mean head capsule width for the first instar was 0.24 mm, second instar 0.36 mm and third instar 0.54 mm (Fig. 4).

After hatching, larvae tunnelled into the vascular tissue of the plant stems under the epidermis, generally in a longitudinal direction. Larger larvae tunnelled into both vascular and pith tissues and also around the circumference of stems at each node beneath the petiole sheath. There was a general tendency for third instar larvae to tunnel towards the base of stems. Many eggs were deposited on developing fruit but tunnelling by the larvae was not observed to damage the developing embryo. Larvae in the fruit, midribs, and petioles tunnelled towards and into stems.

The average length of final instar larvae was 3.7 mm (range 2.8 - 4.2).

Pupae. Pupae averaged 2.8 mm (range 2.4 - 3.3) long. Two methods of pupation were observed in the insectary: (1) in pupal chambers within the stem material; (2) in pupal cases within hollowed out stem sections. Pupal cases were a construction of frass material secreted together to form a shell. They were constructed by the final instar larvae and were irregularly oval in shape, measuring 3.0 x 2.0 mm. Larvae and pupae taken from chambers and cases developed similarly on moist filter paper and adults emerging from chambers and cases fed and oviposited normally. In the field pupation occurred in chambers and no pupal cases were found. Pupal cases may be an artifact of high density insectary rearing.

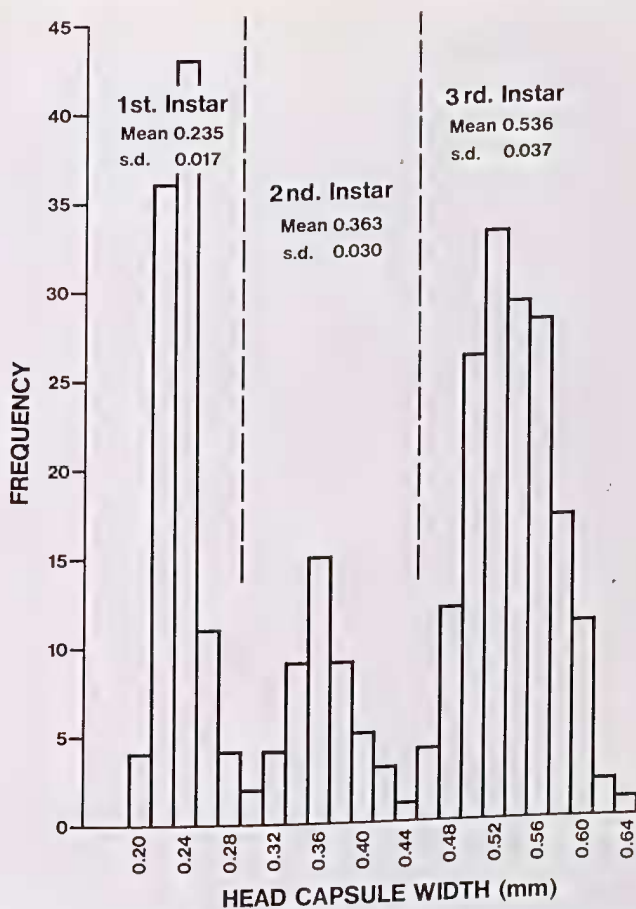


Fig. 4. Separation of larval instars of *Rhinoncus australis* Oke by head capsule widths and the mean, standard deviation and predicted limits for each instar.

Field observations

R. australis appears to restrict its attack to plants of the family Polygonaceae. Since *E. australis* is the only representative of this plant family occurring at several localities where *R. australis* was found, *R. australis* has apparently broadened its distribution, at least locally, using this introduced weed as host. In these areas adults apparently survive for up to seven months between *E. australis* growing seasons, in the absence of alternative host plants.

In insectary cages, *R. australis* severely damaged *E. australis*: plant growth was retarded, seed production reduced and longevity shortened. During 1977 field cage studies were carried out to assess the value of the introduced weevil, *P. antiquum*, as a biological control agent for *E. australis*. *R. australis* was observed attacking the caged plants both in the presence and absence of *P.*

antiquum while in other cages plants remained unattacked by either weevil. Plant assessment indicated that no significant effect on growth or seed production of the caged field plants occurred as a consequence of *R. australis* attack.

R. australis and *P. antiquum* attack and damage *E. australis* in a similar manner. However, attack by these species can be distinguished in the field. Feeding by adult *P. antiquum* is generally restricted to the midrib and upper petioles and causes regular, circular, "shot-holes" in the lamina. *R. australis* feeding is more general and includes stems, the pericarp of developing fruits, and female flowers; feeding holes in the lamina are slightly larger and more irregular and cause a ragged effect. Both species deposit eggs in pits. Plant reaction often produces raised scar tissue around *R. australis* eggs, but none is produced around *P. antiquum* eggs. *P. antiquum* emergence holes are neat, circular, occur along the length of stem, and, except under high populations, there is approximately one hole per emerging adult. *R. australis* emergence holes are slightly larger and less regular and are generally found in the lower two or three internodes. Only two or three emergence holes are cut when numerous adults of *R. australis* emerge from a stem.

Small numbers of immature stages of the weevil were present in *E. australis* during winter but very few adults were observed. Oviposition and development appear to be restricted by the low winter temperatures that occur throughout the range of *E. australis*. Although the weevil populations increased in spring and early summer, this was too late in the growing season to prevent growth or to affect seed production.

Discussion

In an evaluation programme for the biological control of the weed *E. australis* it was recognised that *R. australis* occupies a similar niche to that of *P. antiquum*. Because of the low *R. australis* field populations it is unlikely that interspecific competition will influence the establishment or effectiveness of *P. antiquum*. It is concluded that in the field *R. australis* has no effect on density or reproductive efficiency of *E. australis*.

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References

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